CLAIMS

We claim:

1. A vaporization apparatus for multi-component working fluids comprising:

a plurality of n heat transfer apparatuses arranged in series, each heat transfer apparatus includes:

a heat exchange unit;

a vapor removal unit;

a liquid multi-component working fluid input;

a liquid multi-component working fluid output; and

a vapor multi-component working fluid output in fluid communication with the heat exchange unit; and

a scrubber,

where an input liquid multi-component working fluid stream is fed into the liquid input of the first heat transfer apparatus, each heat transfer apparatus produces a liquid stream and a vapor stream, the first n-1 liquid streams are forwarded to the next heat transfer apparatus in the series, the n^{th} liquid stream and the vapor streams are forwarded to the scrubber to produce a vapor multi-component having a substantially identical composition as the input liquid stream and where the vapor removal units are adapted to maintain substantially nucleate boiling throughout each heat exchange unit and where n has a numeric value of at least 2.

2. The vaporization apparatus of claim 1, wherein n has a numeric value between 3 and 12.

3. The vaporization apparatus of claim 1, wherein n has a numeric value between 3 and 8.

4. The vaporization apparatus of claim 1, wherein n has a numeric value between 3 and 6.

5. The vaporization apparatus of claim 1, wherein the multi-component fluid comprises a low-boiling component a high-boiling component.

6. The vaporization apparatus of claim 1, wherein the multi-component fluid is selected from the group consisting of an ammonia-water mixture, a mixture of at least two hydrocarbons, a

mixture of at least two freon, a mixture of at least one hydrocarbon and at least one freon.

7. The vaporization apparatus of claim 1, wherein the multi-component fluid comprises an ammonia-water mixture.

8. The vaporization apparatus of claim 1, wherein the heat exchange units are selected from the group consisting of a heat exchanger and a heat transfer loop.

9. The vaporization apparatus of claim 1, wherein the vapor removal units are selected from a vapor collector and a vapor-liquid separation drum or tank.

10. A system for extracting heat from a heat source and converting a portion of the heat into a useable form of energy comprising:

a vaporization apparatus of claim 1-9, and

a heat extraction apparatus,

where heat from a heat source stream is transferred to a liquid multi-component working fluid stream having a given composition in the vaporization apparatus to produce a vapor multi-component working fluid stream having a substantially identical composition and where thermal energy transferred from the heat source stream to the vapor multi-component working fluid stream is converted into a more useable form of energy in the heat extraction apparatus.

11. A method for vaporizing a liquid multi-component working fluid comprising the steps of:

feeding a liquid multi-component working fluid stream into a multi-component working fluid vaporization apparatus of claims 1-9 from a energy production facility,

inputting heat from a heat source into the multi-component working fluid vaporization apparatus,

transferring the heat from the heat source to the liquid multi-component working fluid stream to produce a vapor multi-component working fluid stream; and

sending the vapor multi-component working fluid stream back to the energy production facility,

where the liquid multi-component working fluid and the vapor multi-component working fluid have substantially the same composition and the vaporization apparatus maintains substantially

nucleate boiling throughout all heat exchange units. having a given composition into a vapor multi-component working fluid having substantially the same composition, where the method

12. The method of claim 11, wherein the inputting step comprises:

inputting a heat source stream to the multi-component working fluid vaporization apparatus and

the method further comprising the step of:

outputting an spent heat source stream to the source and

13. A methods for vaporizing a multi-component working fluid comprising the steps:

feeding an input liquid multi-component working fluid stream having a given composition into an n^{th} heat transfer apparatus comprising an n^{th} heat exchange unit and an n^{th} vapor removal unit;

transferring heat from a heat source in the n^{th} heat exchange unit to the input liquid multi-component working fluid stream, where the heat causes a portion of the input liquid multi-component working fluid stream to boil;

removing vapor formed during the boiling via the n^{th} vapor removal unit to form an n^{th} vapor stream having a richer composition than the input liquid stream and an n^{th} liquid stream having a higher temperature and a leaner composition than the input liquid stream;

forwarding the n^{th} liquid stream to an $n\text{-}1^{th}$ heat transfer apparatus comprising an $n\text{-}1^{th}$ heat exchange unit and an $n\text{-}1^{th}$ vapor removal unit;

transferring heat from the heat source in the $n\text{-}1^{th}$ heat exchange unit to the n^{th} liquid stream, where the heat causes a portion of the n^{th} liquid stream to boil;

removing vapor formed during the boiling via the $n\text{-}1^{th}$ vapor removal unit to form an $n\text{-}1^{th}$ vapor stream having a richer composition than the n^{th} liquid stream and an $n\text{-}1^{th}$ liquid stream having a higher temperature and a leaner composition than the n^{th} liquid stream;

repeating the forwarding, transferring and removing step, while decrementing the counter by 1 until the counter has a numeric value of 1;

forwarding the 1^{st} liquid stream formed in the 1^{st} removing step and all of the vapor streams to a scrubber;

equilibrating the 1^{st} liquid stream and the vapor streams in the scrubber to produce a vapor multi-component working fluid stream having a composition substantially identical to the composition of input liquid multi-component working fluid stream and a remaining liquid stream;

and

combining the remaining liquid stream from the scrubber with one of the liquid stream prior to forwarding that liquid stream to the next heat transfer apparatus, where that liquid stream has a temperature and composition that most closely matches a temperature and composition of the remaining liquid stream,

where vapor removal units associated with each heat transfer apparatus insure that substantially nucleate boiling occurs throughout each heat exchange unit.

14. The method of claim 13, wherein n is at least 2.

15. The method of claim 13, wherein n has a numeric value between 3 and 12.

16. The method of claim 13, wherein n has a numeric value between 3 and 8.

17. The method of claim 13, wherein n has a numeric value between 3 and 6.

18. The method of claim 13, wherein the multi-component fluid comprises a low-boiling component a high-boiling component.

19. The method of claim 13, wherein the multi-component fluid is selected from the group consisting of an ammonia-water mixture, a mixture of at least two hydrocarbons, a mixture of at least two freon, a mixture of at least one hydrocarbon and at least one freon.

20. The method of claim 13, wherein the multi-component fluid comprises an ammonia-water mixture.

21. The method of claim 13 wherein the heat exchange units are selected from the group consisting of a heat exchanger and a heat transfer loop.

22. The method of claim 13, wherein the vapor removal units are selected from a vapor collector and a vapor-liquid separation drum or tank.